Savannah River Site
Dose Reconstruction NEWS
Phase II: Source Term Calculation and Environmental Pathway Data Retrieval

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Estimates of Releases from the Savannah River Site

An important part of the work in Phase II of the Savannah River Site (SRS) Environmental Dose Reconstruction Project is developing release estimates for chemicals and radionuclides. These release estimates are called *source terms* because they represent the source of the contaminants and are the starting points for calculating environmental exposure to the contaminants. We need to answer several questions during this work:

- What chemicals and radionuclides were released?
- How much of each of these contaminants was released?
- When did the releases occur?
- Where did the releases occur?
- What were the chemical and physical forms of the released material?

Answers to these questions will provide information to determine how contaminants moved through the environment (in the air, water, and food) and to calculate doses to people who have lived near the SRS during its past years of operation.

Release Categories

Three types of releases are the primary emphasis of the work: discharges to the atmosphere via stacks or building vents, releases to surface water, and releases to holding ponds or basins. Releases to the atmosphere were carried by the winds to offsite locations around the SRS. Surface water releases generally flowed into the Savannah River and to points of public exposure. Discharges to seepage basins often entered shallow groundwater that subsequently reached the land surface and contributed to the surface water releases from the site. Some of the discharges to seepage basins were carried to deeper groundwater formations. Discharges to deeper groundwater do not appear to have been a significant source of offsite exposure in years past, but they could prove to be important in the future. Deep groundwater discharges are not a major focus of the dose reconstruction project because this work focuses on past exposures and doses.

Examining Releases that Are Most Important

As part of Phase I of the SRS project, *Radiological Assessments Corporation (RAC)* ranked the radionuclides known to have been released from the SRS in terms of their potential offsite radiation dose. The rankings for airborne and liquid contaminant releases focused attention on the most important radionuclides. A similar ranking was performed for chemicals to guide efficient use of Phase II resources.

Best Estimates Sought

The goal while developing the source term is to provide best estimates of the releases. These might also be called central estimates to indicate that they are not intentionally biased to be high or low. This approach differs from that frequently used in other studies in which worst case scenarios (providing high estimates) are analyzed. Central estimates provide source terms that lead to best estimates of the doses and risks to which people may have been exposed.

Time Histories Will Be Prepared

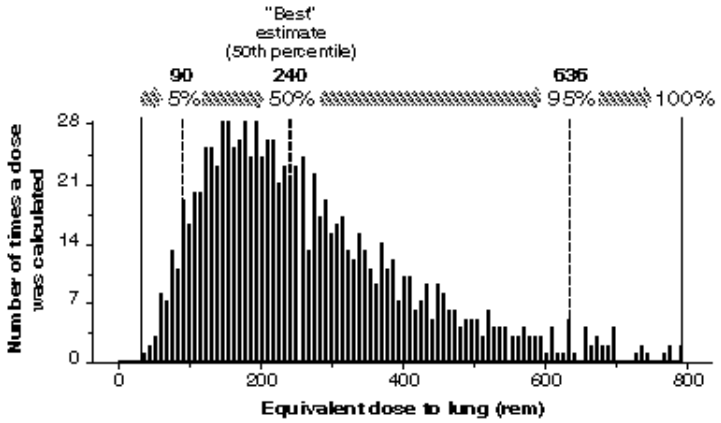
While examining available information, we look for patterns of changes in release rates over the years. These patterns can help us understand when offsite exposures to released materials may have been the greatest, indicating that other researchers should examine these years more carefully. For example, releases during the earliest years of site operation were often higher because the effluent cleanup equipment was not as efficient in the 1950s. On the other hand, releases of certain materials, including tritium and hard-to-filter volatile materials such as iodine, may be higher in later years during periods of high production or equipment failures.

Uncertainties to Be Estimated

It is important to understand the accuracy of the project's eventual estimates of offsite human dose. If we are confident that an estimate is nearly correct, or if we know that an estimate has a very wide range of uncertainty, we must make either conclusion clear to our audience. A wide range of possible doses might include very low values with little associated risk, and high values with significant potential risk.

While collecting information about the site's releases, the movement of hazardous materials offsite, and the populations who may have inhaled or eaten these materials, we also collect data to establish the level of certainty we have in these numbers. For example, we might evaluate the accuracy of the measurements themselves, or the ability of a particular model to predict offsite air concentrations. Then, when a final dose or risk estimate is made, these uncertainty estimates are used to establish a range of possible results placed around our best single estimate.

For example, in a recently completed project, *RAC* results show both our best estimate of dose and the large range within which we think the actual dose may have fallen. It is also possible that the actual dose may be outside this range. As can be seen in the Ohio project illustration below, there is a 5% chance (1 chance in 20) that the actual dose may be less than 90 rem and a 5% chance that it may be more than 636 rem.



Results from a recent RAC study in Ohio. Source term and other information were used to make a best estimate of dose and to develop a range of uncertainty around the estimate. A computer program uses uncertainty information to calculate the percentiles of dose estimates.

Methods of Estimating Releases

While we review old records describing past SRS releases, we examine the data collection and analysis methods used at the time to see whether past unrecognized errors can now be corrected. For example, we may make careful estimates of releases that weren't recorded because of missing samples, or we may change measured values to correct for sampling problems that are now apparent. When we make these corrections, we note in our reports why these data were changed.

The method used to estimate releases during periods when there was no sampling or monitoring depends on the nature of the release and the length of time for which data were not available. Short gaps in a data record may be estimated by interpolation (simply extending the existing data across the gap). In other situations, it may be better to make estimates using our understanding of links between facility operations and environmental discharges. Process models (calculations based on our understanding of how the operation worked) or pilot (small-scale) plant data may also be used if those approaches will provide the best estimates. Releases that must be estimated because there were no measurements for an extended period of time are necessarily more uncertain than those for which we find measurements.

Searches for Original Records

Although summary reports of effluent releases at the SRS are available, *RAC* does not simply adopt these reports as the history of SRS hazardous materials releases. Instead, we search for original records of monitoring results to check the summary report values. To date, the project has examined some 50,000 boxes of site records specifically for this purpose. Most of these records are not useful, but a few contain the detailed, original information we need to check and verify summary reports. Others describe the early plant equipment and procedures that help us calculate the corrections and uncertainty values discussed above.

In some cases, handwritten shift logbooks may contain the original information we need. In other cases, the oldest records may be internal weekly or monthly reports used only to produce published summaries and available only in a few copies. These reports typically reflect ongoing data collection and describe problems and solutions, monitoring improvements, and other activities that help us develop unbiased source term estimates.

Sampling techniques generally improved with time. As a result, knowledge of methods used and when they were changed is important to our understanding of the accuracy of release measurements. This information is frequently not contained in summary reports and must be extracted from records that were prepared as the data were being collected.

Comparisons with Environmental Data

It is important to know whether onsite release estimates are consistent with onsite and offsite measurements in the environment. *RAC* is compiling environmental monitoring data as part of the SRS Phase II work. Scientists evaluate the quality of the environmental monitoring data and make appropriate adjustments when necessary. If both the source term and environmental data provide a similar picture of contaminant release and behavior, we have greater confidence in the results. If the two sets of information are not in agreement, the results need further investigation.

An Open, Public Process

Public input is critical to this project. We encourage your input and attendance at public meetings to stay informed on the progress of the research. Public meetings will be held in areas near the SRS and will be announced in each newsletter.

The Centers for Disease Control and Prevention, *Radiological Assessments Corporation*, and South Carolina State University scientists will provide clear and accessible information to the public. Newsletters and fact sheets will be published regularly to provide updates on the progress of the research. Detailed technical information, including copies of the Phase I database describing research material discovered through June 1995, is available upon request.

Addresses for inquires and comments are located below. Individuals with information related to the study are encouraged to call the SRS Dose Reconstruction Project toll-free number, 800-637-4766.

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